

Analysis of Technical Vocabulary Size Among Engineering Undergraduates Based on Year of Study and English Proficiency Level at Universiti Malaysia Pahang

Amri Muaz Azmimurad

Centre for Modern Languages and Human Sciences
Universiti Malaysia Pahang
Pahang, Malaysia

Najah Osman

Centre for Modern Languages and Human Sciences
Universiti Malaysia Pahang
Pahang, Malaysia

Abstract—English for Specific Purposes (ESP) was designed to fulfil the needs of learners learning languages in specific disciplines. ESP concerns on words or terms that are created specifically or have their own definition in specific fields. As engineering students read abundance of technical texts such as manuals and reports that contain numerous technical terms that have specific meaning in the engineering field, the vocabulary knowledge of technical terms is essential for them in order to understand and comprehend the texts. However, engineering students were found to have difficulties whenever they encountered texts filled with abundance of technical terms. Hence, this study aims to investigate the vocabulary size of technical vocabulary among engineering students at Universiti Malaysia Pahang. This research employs two instruments which are technical vocabulary test and semi-structured interview. The test was used in collecting quantitative data while the semi-structured interview was used in collecting qualitative data. The test was administered to 150 students majoring in five different engineering courses who were currently on their third and fourth year of study whereas the interview involved 12 students from five respective engineering courses. The findings show that engineering undergraduates did not have adequate knowledge of technical terms and there was a significant difference in technical vocabulary size among engineering undergraduates based on English language proficiency level. However, there was no significant difference found in technical vocabulary size among engineering undergraduates when they are compared based on their year of study.

Keywords— *English for Specific Purposes, technical vocabulary, engineering field, vocabulary size*

I. INTRODUCTION

Malaysia is one of the countries in which English is treated as the second language [1], and is used in both primary and secondary schools as one of the fundamental subjects. Despite being in line with other compulsory subjects in schools, English is also one of the compulsory subjects to be taken by university students regardless of their majors. One of the reason English is essential for one to master is mainly because of the demands of job markets in which English is the global language for communication and one of the languages that can break communication barrier between people of other languages. English plays an important role in securing oneself a job as it is one of the basic requirements that employers seek

in their future employees. Lower English proficiency results in a lower chance of getting employed by companies and employers. English has become one of the fundamental needs that future employees need to be equipped with before in order to secure a job.

English for Specific Purposes (ESP) has been a long tradition. It was designed and developed to fulfil the needs of using the language in specific field or discipline. Engineering English is one of the areas that fall under the scope of ESP. It is essential for one to learn or acquire the vocabulary of their chosen professions before they involve themselves with the professions. According to [2], ESP has generally rejected literature, due in part to the genre's insufficient coverage of discipline-specific vocabulary. Most students experience the issue of using English in communication which is crucial in both government and private sector [3] especially engineering undergraduates [4]. This issue happened mainly due to their lack of mastery in vocabulary knowledge.

Vocabulary knowledge is one of the building blocks of any language [5]. Vocabulary knowledge can be divided into two groups which are vocabulary breadth and vocabulary depth. The breadth of vocabulary knowledge refers to the number of words the meaning of which one has at least some superficial knowledge [6]. This is supported by [7] which defines vocabulary breadth as vocabulary size or the number of words for which a learner has at least some minimum knowledge of meaning. The depth of vocabulary knowledge, on the other hand, concerns with how well a person knows the word. This knowledge includes the knowledge of using the word in context, knowing its synonyms and its associates. Vocabulary size and vocabulary level are in the same category of vocabulary breadth. According to [8], it is essential for one to have a deep knowledge of a word in order to fully understand the word and be able to use the word properly. [9] state that it is the general vocabulary knowledge of the reader that best predicts how well that reader comprehend the text.

There are a few tests related to measuring vocabulary which is divided into size and depth respectively. Vocabulary Level Test (VLT) is designed to measure one's vocabulary size while Word Associates Test (WAT) is suitable to test on one's vocabulary depth. This is supported by [10] that stated Word Associates Format (WAF) tests are often used to measure second language learners' vocabulary depth with a focus on

their network knowledge. Vocabulary level test as developed by [11] has five level of words which 1,000, 2,000, 3,000, 5,000 and 10,000.

Technical vocabulary is defined as vocabulary that has a specific usage according to specific area or discipline. [12] Defined that technical vocabulary is subject related, occurs in a specialist domain, and is part of a system of subject knowledge. Even though the technical language is new to students, students learning in the second language have a harder time compared to students learning in the first language. According to [13], technical vocabulary knowledge is rising to one of the important knowledges to be mastered with the advances of numerous subject disciplines. Resulting from this situation, many researches has been done to develop ways of assisting one in learning the technical vocabulary knowledge. One of the methods that have been proposed is constructing word lists. There are now numerous word lists that have been constructed according to different disciplines and fields. [14], for example, developed Engineering English Word List (EEWL) that aims to help engineering students in mastering technical vocabulary that later will help them in performing tasks that requires the use of technical terms.

The current research was conducted with the aim to measure technical vocabulary size among undergraduates majoring in engineering field. As stated by [13], it can be implied that engineering undergraduates must possess or equip themselves with adequate technical vocabulary so that they can comprehend technical texts. The students' vocabulary size was compared to their year of study and English proficiency level. According to [15], the students' vocabulary size increases as their level of study increases. In this study, level of study was measured based on year of study. As for English proficiency level, [16] and [17] stated that there was a significant correlation when vocabulary size was compared to students' English proficiency level. It was stated that the higher the proficiency of the students in English, the higher the vocabulary size they have.

Research Questions:

1) *Is there any significant difference in technical vocabulary size among engineering undergraduates based on year of study?*

2) *Is there any significant difference in technical vocabulary size among engineering undergraduates based on English proficiency level?*

II. LITERATURE REVIEW

Carried out a research [18] with the aim to determine the effect of vocabulary knowledge and gaining familiarity with the specific vocabulary content of a reading or listening comprehension test on a group of Iranian English for Foreign Language learners' reading and listening comprehension ability. The research involves 58 students that were group into two groups, a control group and an experimental group. The students ranging in age from 20 to 25 and were currently taking English as a foreign language subject as Shiraz University. The research employed six tests which include multiple-choice vocabulary test, reading test and listening test. The results showed that knowledge of general vocabulary influenced the students' performance on reading comprehension test when

one-way test of analysis variance was run. However, the test showed that there was no effect of general vocabulary knowledge of listening comprehension performance. [18] added that this situation happened might due to the fact that students can return to a word or phrase or sentence while reading text to understand the content better. The research also revealed that providing students with the meaning of specific or key vocabulary items that appear in a reading comprehension test helps the students to perform better on the test. [18] also claimed that the knowledge of specific vocabulary has had a significant impact on the students' performance on the test. The research suggested that more attention should be paid to teaching and learning specific vocabulary as it can help students to comprehend specific texts that they are reading better.

The research on vocabulary knowledge was continued by [19] which investigates on the relationship between vocabulary size and depth for ESP or English for Academic Purposes (EAP). Both vocabulary size and depth are important in helping the students to comprehend text better which resulting in higher performance in test as proposed by [18]. The research involved 112 ESP graduate students at a university in Iran. All students were majoring in different courses namely physics, mathematics, and electronic commerce. The research employed two vocabulary tests in which one test functions to measure the vocabulary size while the other measures vocabulary depth. Vocabulary Level Test was used to measure vocabulary size while Word Associates Test (WAT) measures synonymy, polysemy, and collocation which are the roots of vocabulary depth. The results showed that participants as one group might probably be indicative of the disappointingly low English competence of the Iranian graduate students in general and the participants under study in particular. This research later divided all participants into two groups, low proficient group and high proficient group based on the performance of the vocabulary test. This research also found that there is a very strong positive correlation between vocabulary size and depth for all the participants as one group and participants in the high group. It indicates that the process of vocabulary development with regard to the size and depth of vocabulary knowledge might be accounted for by the same factors for ESP/EAP learners to a large extent [19]. Similarly, the results showed that the low proficient group also has a strong positive correlation between the two tests. The research concludes that there is a significant positive relationship between vocabulary size and vocabulary depth for Iranian ESP/EAP learners. [19] suggested that teaching the vocabulary size and depth separately might not be needed as both dimensions should be taught in combination in foreign language contexts.

The relationship between vocabulary size and learning performance is further investigated by a research by [20] which focused on predicting performance on TOEFL reading item types. Reading item types in the research refers to the reading comprehension items tested in TOEFL which are guessing vocabulary, main idea, inference, reference and stated detail. 213 students from different universities in Iran majoring in English language participated in this research. However, the level of study of the students was not similar as there are some who were doing degree and the rest were already in their master level of study. [20] claimed that sometimes in Iran, some undergraduates surpassed postgraduates in terms of level of vocabulary proficiency. The instruments employed in the

research were vocabulary level test and reading section from TOEFL. VLT which is similar to the instrument employed by [19] was chosen because it is practical, economical, and easy to administer and interpret whereas TOEFL was chosen because, as a widely used high-stakes test, it assesses different item types in reading comprehension and it was easy to administer and score [20].

Conducted a research on [5] vocabulary size which gives focus on receptive vocabulary among undergraduates in English Language Teaching (ELT) Department of a major state in Turkey. The research employs Vocabulary Levels Test by [21] and it was distributed to 104 undergraduates which comprise 76 females and 28 males. The vocabulary level test was given along with a survey pertaining to GPA scores and genders. The results of the vocabulary level tests were compared to the GPA of the students involved. [5] reports that the 2,000-word level test has the highest mean scores among the participating students. Comparing to other word level test, the 10,000-word level test shows the lowest mean scores and it indicates that students have lower vocabulary size on that level of vocabulary. The students show that they have sufficient knowledge of the academic vocabulary that involves sub-technical vocabulary that occurs in many ranges of fields. [5] also reports that there is no significant correlation between the vocabulary size and their GPA in the research. This result is contrary to a research by [18] as their result shows that vocabulary size had an impact on test performance. Similarly, there is also no significant correlation found when the vocabulary size was compared to the gender of the students.

A research [22] investigating the effect of vocabulary depth and size on reading in EFL context. The instruments used in the research are vocabulary size test developed by [23], Word Associate Test by [24], and a reading achievement test that was developed by the researchers. All three tests were distributed to 361 students who were currently in a preparatory programme of Duzce University, School of Foreign Languages. The results showed that there was a positive correlation between the size of vocabulary and the depth of vocabulary. This finding is similar to the finding by [19] which found out that there was a correlation between vocabulary size and depth. [22] added that the larger the size of words the students know, the more deeply they can use those words in reading activity. As for the relationship between vocabulary size and reading performance, the results found that there was a significant effect of vocabulary size on the reading achievement. It implies that the bigger the size of the vocabulary of the students, the better they perform at the reading activity. This result shows a similar correlation between vocabulary depth and reading achievement. The study concludes that both vocabulary depth and size does have a significant effect on students' reading performance. This result is similar to [18] as they found out that vocabulary size does have an impact on test performance.

A study by [15] investigated the relationship between self-regulation strategies on vocabulary size among EFL Turkish University students. The research employs two instruments which are a 150-item Schmitt vocabulary test and a self-regulation questionnaire. Both the test and questionnaire were administered to 179 students from two different universities. The study measures the students' receptive vocabulary size in which the results show the difference between advanced level students and intermediate and pre-intermediate students' vocabulary size. [15] suggests that vocabulary size of the

students increase as to continue their learning to the higher level. This research also suggested that there were no significant differences in vocabulary size between male and female students. The result also showed that there is a significant correlation between vocabulary size and self-regulated learning components in which the higher the vocabulary size of the students, the more self-regulated learning components the students possess.

Conducted a research [25] investigating on technical vocabulary proficiency among engineering students who were currently undertaking English for Engineers course at a university in Thailand. The technical vocabulary proficiency obtained from technical vocabulary test was compared to students' educational background. The result of this research shows that students with educational backgrounds of the vocational stream had higher proficiency in technical vocabulary compared to students with general education stream background. [25] implied that the differences in technical vocabulary proficiency between students with general stream education and vocational education are due to the differences in curriculum and courses provided by both institutions. The research suggests that students from vocational education background had adequate experiences in terms of constructing words' meaning during the process of acquiring technical words.

A research [16], proposed another use of Productive Vocabulary Level Test (PLVT) which has been used to measure vocabulary size among second language learner, which is to be used as self-efficacy enhancer to motivate low English proficiency (LEP) learners. Vocabulary Level Test (VLT) has been used to measure second language learners' vocabulary size and it has been considered as the closest thing to standardly test on vocabulary knowledge [26]. [27] developed a different version of the VLT which is called PVLT. PVLT functions to test on controlled productive vocabulary which differs from VLT which measures the receptive vocabulary knowledge. Controlled productive or active vocabulary refers to words that a learner could use only when prompted as in sentence construction or fill-in tasks which is different from free productive vocabulary, that refers to words that learners can use freely as in composition writing tasks without prompting [16].

480 English as Second Language (ESL) learners from secondary schools in a district in Malaysia participated in the research. The participants just obtained their Malaysian University English Test (MUET) results about one month prior to the research. Majority of the students belong in the Band 2 and Band 3 group while none of the students scored Band 6 which is the highest score in the MUET. The results of the research showed that there was a significant difference in mean score of the test between students in Band 2 and Band 3, and Band 3 and Band 4. However, there was no significant difference found in the lower bands, Band 1 and Band 2, and the higher bands, Band 4 and Band 5. [16] claimed that learners with high language proficiency would achieve higher scores in the test compared to learners with low language proficiency.

Conducted a research [17] with the aim to analyze the relationship between receptive vocabulary size in advanced learners and EFL proficiency and the skills of reading, writing, listening and speaking. The research involved 42 Catalan or

Spanish first-year undergraduates majoring in English Studies as sampling. The instruments employed in this research were Vocabulary Size Test: X_Lex and Y_Lex. Both tests are computer tests that measure one's receptive vocabulary size which is the amount of words a person knows in English. The test takers were given set of words and have to decide whether they know the meaning of the word given or not. Participants were also given a proficiency test which covers five different sections which are listening, reading, writing, grammar, and vocabulary. Oral proficiency test for the students was done using semi-guided interview in which the students had to answer several open questions on topics that had been seen in the course before. The students were grouped into a group of three and a second evaluator was present to assess the test. The results showed that there was a strong correlation between vocabulary size and general EFL proficiency. [17] proposed a hypothesis that the larger the receptive vocabulary, the higher the proficiency.

The research also found that writing and reading correlate moderately with vocabulary size followed by speaking and listening. In the skills of speaking, oral fluency was found to be the aspect that most closely related to receptive vocabulary size leaving grammar and vocabulary, and pronunciation behind. Regression result of the study showed that receptive vocabulary size explains proficiency to a large extent and can predict writing and reading abilities up to around 30% and to a lesser extent, speaking and listening abilities. The high correlation found between proficiency and vocabulary size (and the explanatory power of the variable size in the regression analysis) supports the use of vocabulary size as an indicative measure for overall L2 proficiency. [17] suggested that receptive vocabulary size has a considerable influence on proficiency which is similar to the finding by [16] which suggested that the higher the proficiency of the students, the higher they score in vocabulary test and have a determinant role in EFL proficiency and the four skills of writing, reading, speaking, and listening.

III. METHODOLOGY

This study employs two instruments in data collection which are a vocabulary size test and a semi-structured interview. The former collects quantitative data while the latter covers qualitative data collection.

A. Vocabulary Size Test

The vocabulary size test was used in this research to measure the size of technical vocabulary among engineering undergraduates in Universiti Malaysia Pahang. The test format was adapted from [11] vocabulary level test. According to [28], the test is a tool to measure the written receptive vocabulary knowledge which is the word knowledge that is required for reading. The words that were used in testing the vocabulary size was taken from a word list developed by [14] named Engineering English Word List (EEWL). The word list consists of words or terms that were coined from engineering textbooks and they were divided into academic and technical vocabulary groups. However, this research only used the words in the technical vocabulary group. The test was examined and validated by two senior English lecturers before the test is distributed to the students.

B. Semi-structured Interview

The interview was conducted after the process of collecting quantitative data using vocabulary size test was finished. The interview was a one-to-one interview in which was chosen to avoid students copying other students' responses. The interview question was adapted from [29] and [30]. All interview questions were validated using Interview Protocol Refinement (IPR) developed by [31] to strengthen the reliability of the interview protocol.

C. Sampling

150 students majoring in engineering from five different faculties at Universiti Malaysia Pahang participated in this study and 12 students were chosen to be participating in the interview sessions. The students were selected using purposive sampling based on three criteria; they are majoring in engineering, they have passed English for Technical Communication course and they are currently in their third or fourth year of study. The students were also asked to state their MUET band and it was found that all students have MUET band ranging from Band 2 to Band 5. There was no student with either Band 1 or Band 6.

D. Data Collection and Data Analysis

The participating students in this research were informed beforehand about the purpose of the study and the confidentiality of the data before the test was distributed to them. The test took 20 minutes to be completed. The data of this test were analyzed using SPSS. Independent T-test and One-way ANOVA were used to determine the differences of technical vocabulary among engineering undergraduates based on year of study and English proficiency level.

IV. RESULTS

The results were analysed using descriptive statistics, Independent T-test and One-way Anova. The results are presented according to the research questions.

Table I shows the mean score of technical vocabulary size among engineering undergraduates as a whole. According to [32], in order for one to be considered having sufficient vocabulary size, one has to score at least 80% of the test which is 34 in this test. The result shows that engineering undergraduates do not have sufficient vocabulary size in technical vocabulary as the mean scores shows 31.17 which does not reach the minimum score of 34. It means that engineering students only score 74% of the technical vocabulary size test.

Table II present the result of technical vocabulary size among engineering undergraduates with different year of study. It is found that there is not much of a difference in both of the mean scores with 31.20 for third year students and 31.09 for fourth year students. This might be due to the difference in year of study which is one year which indicates that the students from both third and fourth year might have similar size of technical vocabulary.

Table III presents the result of Independent T-test which was done to determine the significant difference in technical vocabulary size among engineering undergraduates according to year of study. It was found that $p > 0.05$, which means that there was no significant difference in technical vocabulary size

among engineering undergraduates when they were compared according to year of study. There was no significant difference in technical vocabulary size for students in third year of study ($M = 31.2, SD = 5.78$) and fourth year of study ($M = 31.1, SD = 4.38$) conditions; $t(184) = 0.12, p = 0.91$.

TABLE I. TECHNICAL VOCABULARY SIZE AMONG ENGINEERING UNDERGRADUATES

N	Mean	Std. Deviation
150	31.17	5.379

TABLE II. TECHNICAL VOCABULARY SIZE BASED ON YEAR OF STUDY

Year of Study	N	Mean	Std. Deviation
3	105	31.200	5.775
4	45	31.089	4.374

TABLE III. RESULT OF INDEPENDENT T-TEST

	F	t	df	Sig. (2-tailed)
Equal variances assumed	3.430	.116	148	.908*
Equal variances not assumed		.129	108.661	.898

Table IV shows that there is difference in mean scores between English proficiency levels. Students with MUET Band 2 have the mean score of 27.73 while students with Band 3 have the mean score of 30.59. Both groups of students do not pass the minimum score of 34 which implies that students from these groups do not have the adequate mastery of technical vocabulary. Students with Band 4 shows higher mean score from students with Band 2 and Band 3 with mean score of 34.58. Similarly, students with Band 5 also show the same result with mean score of 37.33. Both group of students with Band 4 and Band 5 pass the minimum score of 34 which implies that they have the adequate size of technical vocabulary. It can be seen that the technical vocabulary size increases as the English proficiency level increases.

Table V presents the results of One-way ANOVA in which was done to determine the significant difference in technical vocabulary size among engineering undergraduates according to English proficiency level. It was found that $p < 0.05$ which implies that there was a significant difference in technical vocabulary size among engineering undergraduates with different level of English proficiency, $F(3, 146) = 17.30, p = 0.000$.

TABLE IV. TECHNICAL VOCABULARY SIZE BASED ON ENGLISH PROFICIENCY LEVEL

MUET Score	N	Mean	Std. Deviation
2	37	27.730	5.226

3	69	30.594	4.716
4	38	34.579	4.131
5	6	37.333	3.266

TABLE V. RESULT OF ONE-WAY ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1130.302	3	376.767	17.295	.000*
Within Groups	3180.531	146	21.784		
Total	4310.833	149			

V. DISCUSSION

Engineering undergraduates in University Malaysia Pahang were found to be lacking in technical vocabulary size. The findings showed that engineering undergraduates did not pass the minimum level of vocabulary knowledge in which it implies that the students might not be able to understand certain technical words or terms that they may encounter when reading technical texts such as manuals, textbooks and procedures. Vocabulary knowledge are closely related to four different skills which are reading, writing, listening, and speaking. Based on a study by [17], vocabulary knowledge has a significant correlation towards these four skills especially reading and writing. Thus, the lack of vocabulary knowledge in technical vocabulary among engineering undergraduates might cause them to not be able to comprehend the technical materials that they read or producing technical materials. This is also similar to a study conducted by [22] in which they claimed that there was a significant effect of vocabulary size on the reading achievement. It implies that the bigger the size of the vocabulary of the students, the better they perform at the reading activity. [18] also claimed that the knowledge of specific vocabulary has had a significant impact on the students' performance on the reading test. Thus, it can be implied that having adequate vocabulary knowledge is important especially in reading activities.

It is also found that the students differ in technical vocabulary size according to level of proficiency which is measured by using MUET scores. It can be implied that the student's level of technical vocabulary size increases as their level of proficiency increases. Previous studies also found similar result in which level of vocabulary size increases as their level of English proficiency increases. This may suggest that they have higher general vocabulary size, thus make them easier in acquire more vocabulary. This is similar to a research by [17] which results showed that there was a strong correlation between vocabulary size and general EFL proficiency. They also proposed a hypothesis which is different from current study in which the larger the receptive vocabulary, the higher the proficiency.[16], in their study, claimed that learners with high language proficiency would

achieve higher scores in the vocabulary test compared to learners with low language proficiency suggesting that the higher the language proficiency, the higher the performance of students in the test

However, there was no significant difference found when the technical vocabulary size of the students was compared to their year of study. This may be due to the fact that the students are from third and fourth year of study. The result might be different if they are compared between the first year and fourth year of study.[15], in his study, claimed that the vocabulary size increase as the student continue the learning to higher level. This claim was not in line with the result of current study as the mean score of students in third year is higher than students in their fourth year. A research by [25] suggests that students from vocational education background had adequate experiences in terms of constructing words' meaning during the process of acquiring technical words. This situation might be useful to be included in comparing year of study as it also involves experience. [25] suggest that experience can be one of the factors that might influence technical vocabulary knowledge. Thus, students with more experience or more years of study would have higher technical vocabulary knowledge. However, the situation is different based on a claim made by [20] as he stated that sometimes in Iran, some undergraduate's surpassed postgraduates in terms of level of vocabulary proficiency. This implies that year of study or level of study can differ according to context and situation.

VI. CONCLUSION

Technical vocabulary knowledge is important for people in specific disciplines as they need to use technical terms in four language skills namely reading, writing, speaking and listening. Engineers, especially, will encounter numerous technical terms or jargons that are related to engineering field in performing daily tasks such as reading manuals, writing reports and speaking technical matters to other engineers. Thus, equipping oneself with adequate knowledge of technical vocabulary is essential as it is heavily used in the engineering field. As for students, especially those majoring in engineering field, need to read and comprehend engineering materials such as reports and textbooks in their study, they as well need to have adequate technical vocabulary knowledge in order to understand the materials better. Measuring and identifying vocabulary knowledge among students is the first step in helping them in equipping themselves with adequate vocabulary knowledge. This study revealed that engineering students do not have adequate technical vocabulary knowledge in which puts them in trouble especially in reading activities. Thus, this study suggests further study to be carried out in determining ways to increase the students' technical vocabulary size as well as providing them with knowledge on technical vocabulary depth so that they can use the terms in writing activities.

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